IAF SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (Part 2) (4B)

Author: Prof. Michèle Lavagna
Politecnico di Milano, Italy

Dr. John Robert Brucato
INAF - Astrophysical Observatory of Arcetri, Italy
Dr. Giovanni Zanotti
Politecnico di Milano, Italy
Mr. Francesco De Cecio
Politecnico di Milano, Italy
Mr. Enrico Belloni
Politecnico di Milano, Italy
Ms. Alice Dottori
Politecnico di Milano, Italy
Dr. Fabrizio Fiore
INAF - Istituto Nazionale di AstroFisica, Italy
Dr. Silvia Natalucci
Italian Space Agency (ASI), Italy
Dr. Alberto Fedele
ASI - Italian Space Agency, Italy
Dr. Marilena Amoroso
Italian Space Agency (ASI), Italy
Dr. Andrea Meneghin
Italy

CUBESAT PARADIGM EXPLOITATION FOR DEIMOS MOON SCIENTIFIC INVESTIGATION: THE TASTE MISSION PHASE B ACTIVITIES

Abstract

Deimos and Phobos are considered primary targets of investigation to understand the origin and evolution of Mars and more in general the terrestrial planets of the Solar System. While there is no clear consensus on a definitive scenario for the moon's formation, two major hypotheses are considered among the scientific community: giant impact origin or asteroid capture. To unveil the origin and evolution of Phobos and Deimos, in the context of international exploration of the Mars system, it is necessary to have detailed knowledge of both moons. To date, no spacecraft mission explored either Phobos or Deimos as a primary objective: the JAXA Martian Moons Exploration (MMX) mission is planned to be launched in 2026, targeted at Phobos. The Italian Space Agency financed TASTE mission is part of the ALCOR program and focuses on Deimos combining both global observations from a close orbit and on surface analysis with a lander equipped with a soil sampling tool. TASTE - Terrain Analyzer and Sample Tester Explorer – currently in phase B, conceived as a CubeSat in CubeSat: 16U satellite, 4U of which are dedicated to a ballistic lander. The orbiter embarks a X-gamma ray spectrometer for chemical

abundance prospecting, and a VIS camera for moon mapping: the former is a customized miniaturized payload currently at TRL6; the latter is a miniaturized TRL9 COTS, even recently tested in deep space.

The lander, which clusters innovative solutions, is equipped with a small compact, stand alone integrated innovative sampling tool which minimizes the sample handling from soil to analysis chamber. The sampler is supposed to penetrate the soil a few centimeters depth to collect and directly deliver specimen into the sealed experimental chamber where a lab-on-chip is installed. That is the core of the on-surface astrobiology experiments which leans on immunoassay techniques exploiting chemiluminescence detection. The paper will report about the progress in consolidating this challenging mission design and the crucial technologies needed: from the electric thruster, to the deep space transponder, to the orbiter autonomous navigation and the robotics on board the 4U lander to properly act on Deimos. The interplanetary transfer needs are also presented together with the proposed development plan and breadboarding activities status to consolidate the mission towards implementation.